

Meat Safety News Digests

A collection of recent news relevant to the safety of red meat prepared by the Food Safety Program of Meat & Livestock Australia, for SAFEMEAT Stakeholders

E. COLI

Numbers of *E. coli* and their relationship to the prevalence of *E. coli* O157:H7 on hides of carcasses at a large beef packing plant

Canadian researchers conducted a study to determine relationships between *E. coli* and *E. coli* O157:H7 on hides. All samples were collected from carcasses immediately prior to hide removal over 8 weeks in summer (n = 591) and winter (n = 686). *E. coli* were detected highest in summer, although detection of *E. coli* O157:H7 was not affected by season. It was also found that *E. coli* numbers did not vary by season, but rather vary by slaughter plant hygiene schedules. *E. coli* O157:H7 was likely to be detected on hides when the high numbers of *E. coli* were observed ($>3.5 \log \text{ CFU}/50 \text{ cm}^2$). However, the likelihood of detecting *E. coli* O157:H7 did not differ when *E. coli* numbers were $<3.5 \log \text{ CFU}/50 \text{ cm}^2$. The results of this study indicated that there was no relationship between numbers of *E. coli* and detection of *E. coli* O157:H7 on hides for 83% of carcasses.

<http://www.ingentaconnect.com/content/afp/jfp/2013/00000076/00000007/art00017>

***Escherichia coli* O157:H7 strains isolated from supershedding cattle**

This USA study investigated the contribution of *E. coli* O157:H7 strain type to supershedding and determined if supershedding was restricted to a specific set of *E. coli* O157:H7 strains. Swab samples (n = 5,086) were collected from feces of cattle at feedlots or during harvest. It was found that supershedders (i.e. having $\geq 10^4 \text{ CFU}$ of *E. coli* O157:H7/gram) constituted 2.0% of the bovine population tested. Characterization of supershedder isolates was performed by pulsed-field gel electrophoresis (PFGE, a DNA fingerprinting technique), phage typing, and Stx-associated bacteriophage insertion (SBI) site determination etc. The Isolates from supershedding cattle represented 52 unique PFGE patterns, 19 phage types, and 12 SBI clusters. This indicated that there is no clustering to *E. coli* O157:H7 genotypes responsible for supershedding. Given that all isolates were obtained directly from cattle, they tended to have high frequencies of traits associated with human clinical isolates. It was concluded that no exclusive genotype was identified that was common to all supershedder isolates.

<http://aem.asm.org/content/79/14/4294.abstract?etoc>

SALMONELLA

Challenge models to evaluate the efficacy of a vaccine to reduce *Salmonella* in peripheral lymph nodes of cattle

This American study aimed to develop and refine challenge models to evaluate an intervention applied at the animal level and to provide preliminary estimates of efficacy of an intervention (i.e., a vaccine) to aid in the design of future studies. Calves were randomly chosen to serve as control or to be administered a *Salmonella* vaccine. In all four experiments, both control and vaccinated calves were inoculated with *Salmonella* strains Montevideo or Newport, and in the fourth experiment, *S. Senftenberg* was also used. The first three experiments involved with the calves orally challenged with a *Salmonella* strain, whereas a transdermal route of challenge was explored in the fourth experiment using a 10-lancet, allergy testing instrument. All calves were then euthanized 14 to 42 days after inoculation, and peripheral lymph nodes (PLNs) were collected. In the first experiment, no differences in the prevalence of *Salmonella* in PLNs were observed between control and vaccinated calves after 14 days post-inoculation. By day 21, fewer PLNs appeared to be positive for *S. Newport* from vaccinated calves than control calves. In experiment II, only two PLNs were found to be positive for *Salmonella* during the first two necropsies (14 and 28 days post-inoculation), therefore, this experiment was terminated. In experiment III, no significant differences in the recovery of *Salmonella* from PLNs were observed from control and vaccinated calves. In the transdermal challenge model (the fourth experiment),

transdermal inoculation resulted in predictably PLNs positive for *Salmonella*, and the effects of vaccine was detected in which the likelihood of recovery of *Salmonella* was lower among vaccinated calves compared with controls. The results of this study suggested that the transdermal route of challenge should be used to evaluate the impact of interventions designed to reduce the carriage of *Salmonella* in PLNs.

<http://www.ingentaconnect.com/content/iafp/jfp/2013/00000076/00000007/art00019>

Transdermal challenge model of *Salmonella* in calves

Recently, several studies have found that *Salmonella* could be routinely recovered from peripheral lymph nodes (PLNs) of cattle presented for harvest. The presence of this food-borne pathogen in PLNs has been reported to be able to survive from currently used postharvest and in-plant intervention strategies. Therefore, *Salmonella* within PLNs may be a potential contaminant of ground beef. The purpose of this American study was to develop a challenge model that effectively and consistently results in the presence of *Salmonella* in PLNs. Calves were inoculated intra- and/or transdermally by applying a 10-lancet skin-allergy instrument deliberately contaminated with *Salmonella* over various ventral regions of the skin. Recovery of *Salmonella* was successful and predictable from region-specific PLNs up to 8 days post-challenge. Furthermore, it was found that only those serotypes inoculated within specific regions were recovered from those PLNs of the same regions, indicating the low possibility that the isolates recovered were a result of previous exposure and not of the current

challenge. The model developed herein could be used to predictably infect PLNs with *Salmonella*, as well as to determine the duration of infection and to evaluate candidate interventions that may shorten the duration of infection.

<http://www.ingentaconnect.com/content/iAFP/jfp/2013/00000076/00000007/art00018>

Diversity of *Salmonella* recovered from lymph nodes, feces and hides of cattle

In this study, American researchers investigated the diversity of *Salmonella* recovered from lymph nodes (mandibular, mesenteric, mediastinal and subiliac; n=68), and fecal (n=68) and hide (n=35) samples. All samples were collected from beef carcasses harvested in an abattoir in Mexico, and screened for *Salmonella*. Presumptive colonies for *Salmonella* were subjected to latex agglutination. A total of 91 strains were obtained and further characterized by serotyping, pulsed-field gel electrophoresis (PFGE, a DNA fingerprinting technique) and antimicrobial susceptibility phenotyping. The results indicated that *Salmonella* was isolated from 100% (hide), 94.1% (feces), 91.2% (mesenteric), 76.5% (subiliac), 55.9% (mandibular), and 7.4% (mediastinal) of the samples. Of the 87 typable isolates, eight serotypes of *Salmonella* were identified. These included Kentucky (32.2%), Anatum (29.9%), Reading (17.2%), Meleagridis (12.6%), Cerro (4.6%), Muenster (1.1%), Give (1.1%), and Mbandaka (1.1%). It was found that *S. Meleagridis* was more likely recovered from lymph nodes than feces or hides, whereas the likelihood of detecting *S. Kentucky* was higher from feces and hides than lymph nodes. The

majority (59.3%) of *Salmonella* appeared to be susceptible to all antimicrobial classes tested and 13.2% of the isolates conferred multidrug resistance. Typing by PFGE revealed that *Salmonella* were generally clustered by serotypes. However, some serotypes (Anatum, Kentucky, Meleagridis and Reading) were comprised of multiple PFGE subtypes, and hence these serotypes were isolated from multiple sample types. Because of over-representation of some serotypes within lymph nodes, it was hypothesized that certain serotypes of *Salmonella* might be better at entering the bovine host than other serotypes or some might be adapted better within lymph nodes. The results of this study provide useful insights into the ecology of *Salmonella* within cohorts of cattle and offer direction for intervention opportunities.

<http://aem.asm.org/content/early/2013/05/28/AEM.01020-13.abstract?etoc>

RISK ASSESSMENT

Risk assessment of fallen carcasses in beef slaughter establishments

Researchers from the USA employed a risk assessment modelling approach to assess the potential public health effects of proposing standardized treatments for carcasses that fall off the slaughter chain at dehiding. In this study, a combination of six intervention options were examined: 1) water rinse, 2) organic acid rinse, 3) trim, 4) organic acid rinse and trim, 5) carcass trimming and cook, and 6) condemn the carcass. The model output predicted the expected decreases in annual *E. coli* O157:H7 illnesses that might result from the application of each intervention. The results revealed that the number of *E.*

coli O157:H7 illnesses avoided was different between the choice of interventions used; organic acid rinsing (281), carcass trimming (787), organic acid rinsing plus trimming (1533), trimming plus cooking (1539), and carcass condemnation (1520). However, the organic acid plus trim, trim plus cook, and condemn interventions appeared to be the most effective in preventing the number of illnesses. The researchers concluded that a safer, more wholesome beef supply would result if all slaughter establishments implement these best interventions for all fallen carcasses.

<http://www.sciencedirect.com/science/article/pii/S0956713513001138>

EUROPEAN FOOD SAFETY AUTHORITY (EFSA)

Opinion on the public health hazards to be covered by inspection of meat from bovine animals

Salmonella spp. and pathogenic verocytotoxin-producing *E. coli* (VTEC) were identified by a risk-ranking process as current high-priority biological hazards for inspection of meat from bovine animals. This is because traditional meat inspection could not detect these biological hazards. As a consequence, a meat safety assurance system for the farm-to-chilled carcass continuum using a risk-based approach was proposed. There are two key elements of this system: 1) the risk-categorisation of slaughter animals for high-priority biological hazards based on improved food chain information, and 2) the risk-categorisation of slaughterhouses according to their capability to control those hazards.

Palpation and incision omitted during visual post-mortem inspection for

animals may result in reduced spreading and cross-contamination with those high-priority biological hazards. For chemical hazards, dioxins and dioxin-like polychlorinated biphenyls were ranked as being of high potential concern, whereas all other substances were ranked as of medium or lower concerns.

Programmes for monitoring chemical hazards should be flexible and based on the risk of occurrence. It should be taking into account the completeness and quality of the food chain information supplied and the ranking of chemical substances, which should be required for regular updates to include new hazards.

Control programmes are also necessary to be better integrated across the food chain, national residue control plans, feed control and monitoring of environmental contaminants. Meat inspection is an important tool for surveillance and monitoring of animal health and welfare conditions.

Omission of palpation and incision would reduce detection effectiveness for tuberculosis at animal level. This would also lead to a negative impact on the overall surveillance system, especially in officially tuberculosis-free countries. The detection effectiveness for bovine cysticercosis, which is already low with the current meat inspection system, would result in a further decrease, if palpation and incision are removed.

Extended use of food chain information has the potential to compensate for some, but not all, of the information on animal health and welfare that would be lost if only visual post-mortem inspection is applied.

<http://www.efsa.europa.eu/en/efsajournal/pub/3266.htm>

Opinion on the public health hazards to be covered by inspection of meat from sheep and goats

Toxoplasma gondii and pathogenic verocytotoxin-producing *E. coli* (VTEC) were identified by a risk-ranking process as the most relevant biological hazards for inspection of meat from sheep and goats. This is because these organisms could not be detected by traditional meat inspection. Consequently, it was proposed to implement a meat safety assurance system using risk-based interventions. Further studies are still required on *T. gondii* and pathogenic VTEC, and if new information confirms that these biological hazards are a high risk to public health from meat from sheep or goats, setting targets at carcass level should be considered.

Other elements of the meat safety assurance system include risk-categorisation of flocks/herds based on improved food chain information, classification of abattoirs according to their capability to reduce faecal contamination, as well as use of improved process hygiene criteria.

Omission of palpation and incision from *post-mortem* inspection in animals

subjected to routine slaughter is proposed. For chemical hazards, dioxins and dioxin-like polychlorinated biphenyls were ranked as being of high potential concern.

Chemical hazards should be monitored by programmes that are flexible and based on the risk of occurrence. These programmes should be taking into account the food chain information, which should be required to reflect the extensive production systems used, as well as to account the ranking of chemical substances, which should be regularly updated to include new hazards.

If palpation and incision are removed, detection effectiveness for tuberculosis and fasciolosis at animal level would reduce. Surveillance of tuberculosis at the slaughterhouse in small ruminants should be improved and encouraged. This is because it is the only surveillance system available.

<http://www.efsa.europa.eu/en/efsajournal/pub/3265.htm>

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